The Mars Observer Camera

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A camera designed to operate under the extreme constraints of the Mars Observer mission was selected by NASA in April, 1986. Contingent upon final confirmation in mid-November, the Mars Observer Camera (MOC) will begin acquiring images of the surface and atmosphere of Mars in September-October, 1991. The MOC incorporates both a wide angle system for low resolution global monitoring and intermediate resolution regional targeting, and a narrow angle system for high resolution selective surveys. Camera electronics provide control of image clocking and on-board, internal editing and buffering to match whatever spacecraft data system capabilities are allocated to the experiment.

The objectives of the MOC experiment are to:

1) obtain global, synoptic views of the martian surface and atmosphere in order to study meteorological, climatological, and related surface changes during the course of the mission. Global monitoring observations can yield complete coverage of the planet at approximately 7.5 km/pixel in a single 24-hour period.

2) examine and monitor surface and atmospheric features at moderate resolution for changes on timescales of hours, days, weeks, months, and years. The regional targeting mode (used to monitor such time-variable features as lee clouds, the polar cap edge, and wind streaks) will have a resolution of better than 300 m/pixel at the nadir, diminishing to better than 2 km at the limb

3) systematically examine local areas at extremely high resolution in order to quantify surface/atmosphere interactions and geological processes that operate on short timescales and at extremely small spatial scales. Candidate areas for intensive study include layered slopes within the polar layered terrain and the migrating edge of the seasonal polar cap. In the high resolution sampling mode, each image covers more than 2.5 km X 2.5 km at approximately 1.4 m/pixel. Additional capability within the high resolution system allows longer areas to be imaged at reduced resolution (at 11.2 m/pixel, roughly 2.7 km X 180 km).

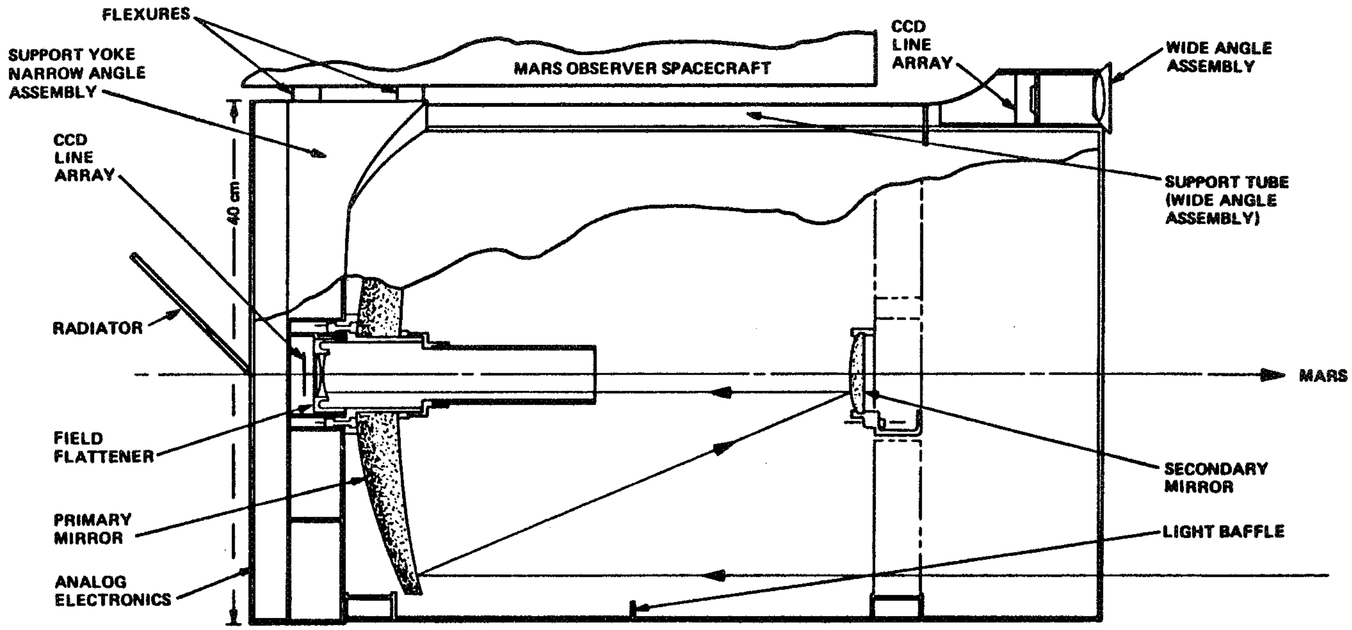
The MOC has two sets of optics: a very short focal length (9.7 mm) "fish-eye" lens and a very long focal length (3.5 m) Ritchey-Chretién telescope, each with its own detector assembly of CCD line arrays, and a shared electronics assembly (Figure 1). The optics are nadir pointing. In operation, the motion of the spacecraft generates the image by "pushing" the line arrays, oriented perpendicular to the velocity and nadir vectors, along the ground track. The cross-track dimension of the image is defined by the length of each CCD detector while the along-track dimension is defined by the length of time the detectors are active. The actual ground track velocity will determine the line exposure time. The cameras are electronically shuttered (i.e., the accumulated charges are shifted from the CCD in a fraction of the time required to advance one resolution element). Fixed spectral filters over each CCD array optimize system optical performance. The wide angle system has two detectors with different color filters, allowing two-color observations to distinguish between dust and condensate clouds, and to distinguish atmospheric from surface phenomena.

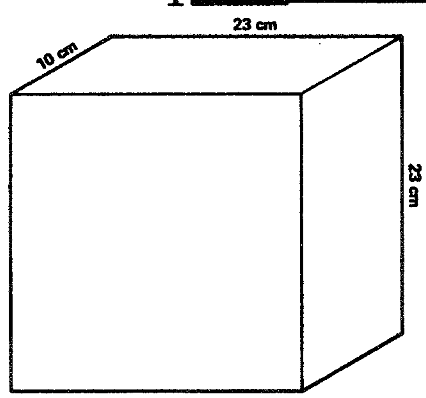
The MOC electronics will be among the most advanced to be flown in space. A 32-bit processor, three high speed gate arrays, and 12 megabytes of random access memory (RAM) provide considerable flexibility in instrument operation, even within the limited resources available to the experiment. The electronics will have processing capabilities approximately equal to a VAX-11 computer, within a package 23 X 23 X 10 cm, about 3 kg in mass, and using about 7 watts of power.

Under present data rate plans, the MOC will acquire several thousand images during the nominal mission (one Mars year), including low resolution global images, and several high resolution images, every day. Although the camera cannot be pointed at specific targets, representative areas of Mars should be accessible to imaging several times during the mission. As mission planning becomes more settled, the MOC Investigation Team will solicit community input for targeting observations.

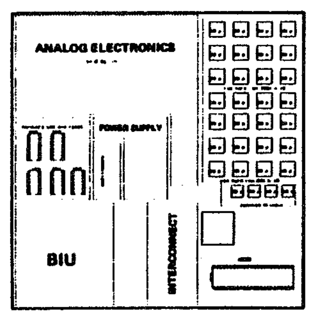
MARS OBSERVER CAMERA

3.5 m f/10 Telescope and 9.7 mm f/6 Fish-Eye Lens

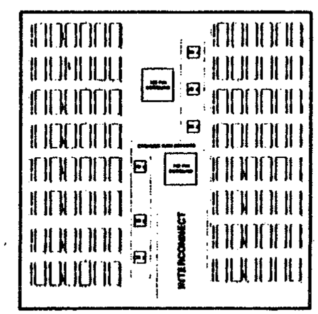




ELECTRONICS ENCLOSURE
(LOCATED INSIDE SPACECRAFT)



PROCESSOR BOARD
- MICROPROCESSOR
- ANALOG ELECTRONICS
- POWER SUPPLY
- BIU



BUFFER MEMORY BOARD(S)
(ONE OR FOUR)